

The University of Otago Junior Mathematics Competition 2024 Competition Report

Department of Mathematics and Statistics

Te Tari Pākarau me te Tatauraka



University
of Otago
ŌTĀKOU WHAKAIHU WAKA

General Comments

The 2024 competition saw the continuation of the two part competition structure. Much like last year there were no major technical issues, and for the vast majority of schools the first part of competition ran smoothly.

There was a reasonable increase in the number of pupils taking part in the Part One of the competition this year: around 5200, up from around 4800 in 2023, continuing the increase in students from 2022 to 2023. In part this was due to an small advertising campaign by the New Zealand Association of Mathematics Teachers to whom we offer our thanks. This year we had candidates sit the competition at 146 schools, another large increase from 2023's 117 schools (but around the same number of schools in 2022). Just like 2023, Part Two of the competition had around 1200 pupils sitting.

A reminder that this year (like in all years after 2020) we will not award Top 100 and Top 200 certificates at all. Like recent years we award Distinction certificates to roughly the top 15% of participants nationwide in each year level, and Merits to roughly the top 50% of participants nationwide in each year level. Note that to achieve a Merit or Distinction, a given pupil must place in the top 50% or 15% respectively in *either part of the competition*. This means that some pupils on your Part Two results sheet will receive Distinctions having earned a lower mark in the second part than other students who have only received a Merit. When a student who sat Part Two has received a Merit or Distinction based solely on their Part One performance, this has been noted on the results sheet.

On the whole the difficulty Part Two of the competition was much the same as last year's competition. For the overall 2024 Part Two scores see the table on page 3.

We continue to emphasise that doing as much as possible in a question before moving onto another question is better than jumping back and forth between questions. Another good idea is to write the answer down with the minimum working possible. Students can return to 'pad' the working out when they have done as much of the competition as they can do. Once again several 'capable' students answered the early questions nearly perfectly but ran out of time and could not do justice to the later ones, mainly because they wrote too much at the beginning. There is a fine line between explaining and over-explaining your answers.

Future Competitions

Due to resourcing issues, at this point in time we do not know if a competition will be held next year, nor do we know what structure the competition will have if it does occur. Ways of running a competition next year (if not beyond) are under active consideration. Please keep an eye on our website for future developments (although we will email schools in the normal manner at the start of next year if the competition is to proceed).

Any feedback (positive and negative) you have about the structure of the competition will be welcomed (although note that the chances of the competition returning to a pre-2020 structure is highly unlikely on a long term basis). This includes your preferred dates for next year — if we run the competition with the same structure next year, the dates for Part One will be in late March / early April, and the date for Part two will be a Wednesday in May.

Brief Comments on Individual Questions

Question One (Year 9 and below)

Like the equivalent question in 2023's competition, this was mostly well answered. As always the aim here is to have something that students with minimal mathematical knowledge can succeed in.

Question Two (Year 10 and below)

Although somewhat similar to the equivalent 2023 question, students found the going a little harder here, although overall marks were high. Prior experience with magic squares was definitely an advantage here. Some students produced semi-magic squares instead (where the rows and columns added to 60 but at least one of the diagonals did not).

Question Three

Students found the going slightly easier here than in 2023. It was perhaps disappointing that so many students did not carefully read the definitions at the start of the question. Many students gave composite numbers for their values of p , q , and r , or chose values that were not distinct. The second part of the question (involving sums of consecutive primes) was done much better than the first part of the question.

Question Four

Here this question continued a trend of increasingly difficult Question Fours, something which will have to be rectified for future competitions. We did not expect students to struggle here compared to Questions Five and Six. The first two parts of the question were frequently well done, however. Explaining answers to part (c) proved beyond most students. A reminder that giving examples when a general proof is required will not earn students any marks.

Question Five

This year the competition tried something novel, in that we asked students to draw a couple of diagrams. Overall this went quite well, so for future competitions we may look at doing something similar. The only downside here was that some students drew very small diagrams — in some cases these diagrams were too small to properly mark, and those students lost marks as a result.

Question Six

In 2023 part of Question Seven involved binary numbers, which went reasonably well (for those students who attempted the question, at least). We expanded that to a full question this year, and the results were at least somewhat encouraging. It's clear that quite a few students had encountered binary numbers, perhaps many more than had when we asked a similar question quite a few years prior. That is not to say the question was easy; in the end only one student in the competition managed to get the complete question correct.

Question Seven (Years 10 and 11)

This was the hardest question in the 2024 competition — no one student got everything correct. Only a handful of students got the correct answer to (d), and even then none of them were able to give a full explanation. The primary reason this was Question Seven and not Question Eight was the fact that little actual knowledge of mathematics is required here. A few students did themselves no favours by not adequately explaining their methods when using combinations to answer the first two parts of the question. There is brief and then there is too brief.

Question Eight (Year 11)

This was the primary geometry question this year. Overall students found the going relatively easy compared to the 2023 equivalent; roughly 10% of students obtained full marks here. In (a) many students successfully used the isosceles triangle formula to come to a correct solution, but in many cases this proved to be their undoing, as using reasonably simple trigonometry here provides a much easier path to an answer for (b).

Percentiles

The percentiles for Part Two of the competition at each level are given below. (The total possible marks for all candidates was 100.) Note that the top papers (about 18% at each level) have been check-marked by experienced members of the Mathematics and Statistics Department of the University of Otago. This does use up considerable time in returning results, but we feel that the greater accuracy in final marks makes the check-marking justified.

	2024			2023		
	Year 9	Year 10	Year 11	Year 9	Year 10	Year 11
Distinction (85%ile)	41	39	45	41	43	40
70%ile	34	33	37	36	36	34
60%ile	31	28	32	32	33	31
Merit (50%ile)	27	24	28	29	31	28
25%ile	19	16	19	22	23	21

A direct comparison to last year's competition is always difficult, but it appears that this year's competition had a comparatively similar difficulty to last year's competition overall. It does seem that Year 11 students, particularly the more capable students, found the going the easiest, while Year 10 students found the paper the hardest overall. This may be because Question 7 was relatively tricky compared to Question 8.

Please check the marks of your students against the marks given above for Distinctions and Merits and let us know if anything seems incorrect about your results.

A note about Merits and Distinctions

Students received a Merit or Distinction based on their *best* performance across both parts of the competition. This means that it was entirely possible to do poorly in the second part of the competition and receive a Distinction if a pupil did very well in the first part of the competition. As a reminder, here are the thresholds for receiving a Merit or Distinction just from a student's results for the first part of the competition:

	Year 9 Threshold	Year 10 Threshold	Year 11 Threshold
Distinction (Top 15% Nationwide)	36	38	41
Merit (Top 50% Nationwide)	23	24	28

For example, A Year 11 student scoring 45 in the first part of the competition and 34 in the second part of the competition would get a Distinction overall, even though their score in the second part would otherwise earn a Merit.

A Note on Calculators

We continue to stress how difficult it is for students without calculators to cope in a Mathematics competition. Even a simple calculator with the 'four basic functions' would save much time. Certainly Years 10 and 11 students cannot be expected to work out the more complicated problems towards the end without a calculator.

Explanation of the Symbols on the Mark-Sheets

The following symbols have been utilised on the mark sheets:

Questions 3, 4, 5, and 6 (up to 20 marks each):

(blank)	No work presented.
0	Work presented, but ungradeable, or fundamentally incorrect.
-	Minimal partial credit (1 – 5 marks).
+	Significant partial credit (6 – 13 marks).
✓	Near complete solution (14 – 17 marks).
✓✓	Full, or near full credit (18 – 20 marks).

Questions 1, 2, 7, and 8 (up to 10 marks each):

(blank)	No work presented or not applicable.
0	Work presented, but ungradeable, or fundamentally incorrect.
-	Minimal partial credit (1 – 4 marks).
+	Significant partial credit (5 – 8 marks).
✓	Near complete solution (9 – 10 marks).

First, Second, Third, and Top 30 Prizes

Schools with students who have received monetary prizes will be sent prize packs via courier. We will do this as soon as all the certificates have been printed — this will likely occur in early September. Apart from certificates each prize pack contains Prezzy cards and physical copies of the model solutions for each student to keep. The unlock code for each Prezzy card will be sent in a separate email - it is most important that you **retain a copy of this email** and pass on the unlock code to your students as soon as they have their physical prizes.

Our Website and email

Please remember to check the front page of our website (particularly the News section) regularly for updates on the availability of results. You should monitor the website before emailing us for information which is already on there. We have emailed results to all schools. Many thanks to those who continue to use email – we have found this to be the most effective form of communication by far, and has reduced our administrative burden no end.

Final comments

Like last year's competition, this year's competition ran smoothly. Once again it was a team effort involving several members of the Department of Mathematics and Statistics.

Thank you to all the schools that have entered the competition over the years. With any luck we hope to see you all next year!